REMARKS

Regarding the status of the present application, Claims 1-4, 9-11, 14 and 16-19 have been amended, and Claims 1-20 are pending in this application. Reconsideration of this application is respectfully requested.

Claim 9 was objected to because of an informality noted by the Examiner. Claim 9 has been amended to address the Examiner's issue and is now considered clear and definite. Withdrawal of the Examiner's objection is respectfully requested.

Claim 17 was rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner noted an antecedent basis issue. Claim 17 has been amended to depend from Claim 16 and is now considered clear and definite. Withdrawal of the Examiner's objection is respectfully requested.

Claims 1-5 and 8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,388,786 issued to Ono et al. in view of US Patent No. 6,445,476 issued to Kahn et al. and U.S. Patent No. 6,389,081 issued to Shimizu et al. It is respectfully submitted that the Examiner's position is in error.

The present invention employs programmable constellation generating apparatus that generates an arbitrary M-ary amplitude modulated and/or phase shift keyed constellation of data points that are input to the amplitude and phase modulator to amplitude and phase modulate the laser beam (see Fig 2, for example). In addition, the present invention implements predistortion of the constellation (see Figs. 6 and 7, for example). I t is respectfully submitted that these aspects of the present invention are not disclosed or suggested in the cited references.

It is respectfully submitted that these concepts are not disclosed or suggested by the cited references, taken singly or together. In addition, it is respectfully submitted that the Examiner's has combined the cited references using hindsight reconstruction, using the teachings of the cited references in light of Applicant's own teachings.

The Examiner's position is that "Ono et al. also disclose an apparatus responsive to input data for generating data points that are input into the amplitude and phase modulator to amplitude and phase modulate the laser beam (column 7, lines 13-45)." The Examiner admitted that Ono et al. "do not specifically disclose a constellation generating apparatus for generating an arbitrary M-ary amplitude modulated and/or phase shift keyed constellation of data points."

The Examiner cited the Kahn et al. patent as disclosing "a constellation generating apparatus for generating an arbitrary M-ary amplitude modulated and/or phase shift keyed constellation of data points." The Examiner cited the Shimizu et al. patent as disclosing "a constellation generating apparatus (Figure 6A) that is responsive to input data and a clock signal (column 6, lines 56-60)."

The Ono et al. patent discusses a method of achieving duobinary modulation which is a special combination of bilevel intensity and bilevel phase modulation of an optical signal. The Ono patent discusses a fixed point constellation, namely duobinary modulation. There is no

disclosure or suggestion in the Ono patent regarding generating an arbitrary M-ary amplitude modulated and/or phase shift keyed constellation of data points, or predistorting such a constellation.

It is respectfully submitted that the Kahn et al. patent does not disclose or suggest the presently claimed programmable constellation generating apparatus as is suggested by the Examiner. In fact, the Kahn et al. patent teaches away from the use of arbitrary M-ary amplitude modulated and/or phase shift keyed constellations of data points.

The Kahn et al. patent discusses duobinary multi-level pulse amplitude modulation of an optical signal, i.e., M-ary amplitude, but only binary phase. There is absolutely no disclosure or suggestion in the Kahn patent regarding generating an arbitrary M-ary amplitude modulated and/or phase shift keyed constellation of data points, or predistorting such a constellation.

It is respectfully submitted that the Kahn et al. patent discloses a duobinary system, and does not employ constellations. The Kahn et al. patent discloses "Methods and apparatus to transmit and receive information bits encoded in duobinary, multilevel pulse-amplitude-modulated (PAM) optical signals" (see Abstract),

Column 2, lines 15-23 of the Kahn et al. patent teaches away from constellations. This paragraph of the Kahn et al. patent states that "Modulation of information bits onto optical signals using M-ary phase-shift keying (for M≥3) or using M-ary quadrature-amplitude modulation (for M≥4) represent other well-known means to narrow the optical spectrum and lengthen the symbol interval of the transmitted signal. However, very complicated phase-sensitive detection techniques are required to recover the transmitted bits, such as synchronous homodyne or synchronous heterodyne detection." The Kahn et al. patent does not disclose or suggest how to accomplish transmission and reception of these very complicated phase-sensitive detection techniques, and in fact teaches a simpler approach that uses duobinary multilevel pulse-amplitude-modulated optical signals.

The Ono et al. patent teaches reduction of bandwidth to reduce dispersion. This is only one feature of what is provided by the present invention. The present invention also predistorts the transmitted data to overcome distortion of the communication link. Furthermore, the present invention compensates for component nonlinearities and self-phase modulation, which is not the goal of any of the cited patents.

The Examiner stated that "Shimizu et al. disclose a related system including a constellation generating apparatus (Figure 6A) that is responsive to input data and a clock signal (column 6, lines 56-60)." It is respectfully submitted that the Examiner appears to be misinterpreting what is presently claimed.

The Shimizu et al. patent discusses QPSK RF modulation of an optical signal. The constellation consists of four points. There is no disclosure or suggestion in the Shimizu patent regarding programmably generating an arbitrary M-ary amplitude modulated and/or phase shift keyed constellation of data points, or predistorting such a constellation.

Furthermore, the Shimizu et al. system transmits a clock signal along with the data signal. This is not what is done in the present invention. The present invention provides for a programmable constellation generating apparatus that is responsive to input data and a data modulator clock signal for programmably generating an arbitrary M-ary amplitude modulated and/or phase shift keyed constellation of data points. Thus, the constellation of data points is generated in response to the input data and clock, but the clock is not transmitted with the constellation. The clock in the present invention is used for synchronization purposes internal to the transmitter only.

None of the cited patents disclose or suggest programmable constellation generating apparatus. The terms "programmable" or "programmable constellation generating apparatus", or any similar concept, are not disclosed in any of the cited patents.

Also, the Shimizu et al. patent teaches only the use of QPSK signals (4 states). The Shimizu et al. patent does not disclose or suggest programmable and weighted signals that compensate for component nonlinearities and self-phase modulation.

In addition, the present invention is programmable, which has been more clearly defined in the pending claims. None of the prior art patents disclose or suggest a programmable constellation generating apparatus as is presently claimed. The prior art patents teach optimization of particular fixed modulation format.

The present invention provides for constellations that have more than two phase states in addition to multiple amplitude states. Again, the Kahn et al. patent discloses a duobinary system wherein the amplitude has multiple levels, but the phase has only two levels. In contrast, an Mary constellation has any arbitrary amplitude and phase.

In view of the above, it is respectfully submitted that the Ono et al., Kahn et al. and Shimizu et al. patents, taken singly or together, do not disclose or suggest the invention recited in Claim 1. In particular, Claim 1 calls for "programmable constellation generating apparatus that is responsive to input data and a data modulator clock signal for programmably generating an arbitrary M-ary amplitude modulated and/or phase shift keyed constellation of data points that are input to the amplitude and phase modulator to amplitude and phase modulate the laser beam", which is not disclose or suggested by the cited patents, taken singly or together.

In view of the above, it is respectfully submitted that the Ono et al., Kahn et al., and Shimizu et al. patents, taken singly or together, do not disclose or suggest the invention recited in Claim 1, and certainly not without the use of hindsight reconstruction. Withdrawal of the Examiner's rejection and allowance of Claim 1 are respectfully requested.

With regard to Claim 3, none of the cited patents, taken singly or together, disclose or suggest "programmable constellation generating apparatus" comprising "programmable amplitude symbol mapping logic" as is recited therein.

With regard to Claim 4, none of the cited patents, taken singly or together, disclose or suggest "programmable constellation generating apparatus" comprising "programmable phase angle symbol mapping logic" as is recited therein. The Examiner argued that the Kahn et al.

patent discloses "phase angle mapping logic that is responsive to input data 21, weighting apparatus (amplifiers 172 and 173), summing apparatus 176, amplifying apparatus." However, it is respectfully submitted that this logic is only operative with respect to a duobinary waveform, not a constellation of -Mary amplitude modulated and/or phase shift keyed data points as is provided by the present invention.

With regard to Claim 2, it has been rewritten to recite both the programmable amplitude and programmable phase mapping logic, which are not disclose or suggest by the cited references, taken singly or together.

With regard to Claim 5, the Examiner stated that "Ono et al. disclose that the modulation format of the optical signal of an optical link is reconfigured to maximize data transmission for a varying available link optical dynamic range (column 7, lines 31-45)." It is respectfully submitted that this is not true. The Ono et al. system is not reconfigurable and is not programmable. Also, there are no statements contained in the Ono et al. patent regarding dynamic range.

With regard to Claim 8, the Ono et al. patent only discusses performance variations in optical fiber. There is no disclosure or suggestion in the Ono et al. patent regarding compensating for performance variations in components of a communication link. Such components include piece parts of the link, such as modulating lasers, amplifiers or detectors, for example.

Dependent Claims 2-5 and 8 are also considered patentable based upon the allowability of Claim 1. Therefore, it is respectfully submitted that the invention recited in Claims 2-5 and 8 are not disclosed or suggested by the Ono et al., Kahn et al., or Shimizu et al. patents, taken singly or together. Withdrawal of the Examiner's rejection and allowance of Claims 2-5 and 8 are respectfully requested.

Claims 9 and 10 were not mentioned in the rejection based upon the teachings of the Ono et al., Kahn et al., and Shimizu et al. patents cited against Claims 1-5 and 8, but based upon the Examiner's arguments, it is assumed that the rejection of Claims 9 and 10 are based upon the teachings of these references.

The arguments above with regard to Claim 1 are considered relevant to the allowability of Claim 9. For the reasons made above, it is respectfully submitted that none of the cited patents, taken singly or together, disclose or suggest "programmably generating an arbitrary M-ary constellation of data points in response to input data and a data clock signal that are used to amplitude and phase modulate the laser beam", or the following processing steps relating to the arbitrary M-ary constellation of data points.

In view of the above, it is respectfully submitted that the Ono et al., Kahn et al., or Shimizu et al. patents, taken singly or together, do not disclose or suggest the invention recited in Claim 9, and certainly not without the use of hindsight reconstruction, for the reasons argued above. Withdrawal of the Examiner's rejection and allowance of Claim 9 are respectfully requested.

Dependent Claim 10 is considered patentable based upon the allowability of Claim 9. Therefore, it is respectfully submitted that the invention recited in Claim 10 is not disclosed or suggested by the Ono et al., Kahn et al., or Shimizu et al. patents, taken singly or together. Withdrawal of the Examiner's rejection and allowance of Claim 10 is are respectfully requested.

Claims 11-18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,388,786 issued to Ono et al. in view of US Patent No. 6,445,476 issued to Kahn et al.

Independent Claim 11 calls for a programmable system for transmitting an arbitrary M-ary modulated optical signal comprising "programmable constellation generating apparatus for programmably generating an amplitude control signal and a phase control signal from an input data signal, wherein the amplitude control signal is input to the amplitude modulator and the phase control signal is input to the phase modulator, together the amplitude control signal and the phase control signal comprising an arbitrary M-ary constellation of data points such that the amplitude and phase- modulated optical signal is an arbitrary M-ary modulated optical signal."

Neither of the cited patents address programmable constellation generating apparatus that programmably generates an arbitrary M-ary constellation of data points. For the reasons discussed above with regard to Claim 1, for example, it is respectfully submitted that there is no disclosure or suggestion contained in the cited patents, taken singly or together, which provides for this aspect of the present invention. The term "programmable" is not used in either of the cited patents. It is also respectfully submitted that in order to reject Claim 11, the Examiner has extended the teachings of the cited references and has used hindsight reconstruction, using the teachings of the cited patents in light of Applicant's own teachings.

In view of the above, it is respectfully submitted that the Ono et al., and Kahn et al. patents, taken singly or together, do not disclose or suggest the invention recited in Claim 11, and not without the use of hindsight reconstruction. Withdrawal of the Examiner's rejection and allowance of Claim 11 are respectfully requested.

With regard to Claims 14 and 15, none of the prior art patents disclose or suggest anything regarding a programmable or adaptable system, which makes it actively responsive to changing link conditions. This concept is not disclosed or suggested in any of the prior art patents cited by the Examiner.

With regard to Claims 16 and 17, the Kahn et al. patent only discloses the use of a duobinary signal having only two phase states.

Dependent Claims 12-18 are also considered patentable based upon the allowability of Claim 11. Therefore, it is respectfully submitted that the invention recited in Claims 12-18 are not disclosed or suggested by the Ono et al., and Kahn et al. patents, taken singly or together. Withdrawal of the Examiner's rejection and allowance of Claims 12-18 are respectfully requested.

Claims 6 and 7 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,388,786 issued to Ono et al., US Patent No. 6,445,476 issued to Kahn et al. and U.S. Patent No. 6,389,081 issued to Shimizu et al. in view of US Publication No. 20030012289 of Lindoff and US Patent No. 6,307,985 issued to Lindoff and US Patent No. 6,307,985 issued to Murakami et al. It is respectfully submitted that the Examiner's position is in error.

It is respectfully submitted that the cited references, taken singly or together do not disclose or suggest anything regarding predistortion of a constellation. The fact that the Lindoff publication discusses RF predistortion is irrelevant to the teachings of the cited patents and to the present invention. There is also no teaching contained in the cited references that would suggest their combination. The has only been achieved using improper hindsight reconstruction on the part of the Examiner.

It is respectfully submitted that the Examiner's arguments are incorrect in that they are backwards. The present invention does not compensate for chromatic dispersion in order to reduce the deleterious effects of self-phase modulation, as does Murakami et al. The present invention predistorts the constellation to compensate for self-phase modulation which in turn reduces the harmful actions of chromatic dispersion. In essence, the present invention treats the cause of the problem, while the prior art treats the symptoms.

Furthermore, with regard to self-phase modulation, the more intense the pulse, the more the phase retards and the data spectrum broadens (i.e., produces a broader optical spectrum). None of the prior art addresses programmably correcting self-phase modulation according to the pulse intensity (i.e.,, nonlinearity, as recited in Claim 6) in order to reduce the effects of chromatic dispersion.

It is applicant's position that optical predistortion is a novel concept taught and claimed in the present application. The use of predistortion in other fields, such as RF or microwave, is not relevant. It is respectfully submitted that no prior art optical system uses optical predistortion to compensate for an arbitrary M-ary amplitude modulated and/or phase shift keyed constellation of data points. [Emphasis added]

The Lindoff system only predistorts an RF constellation in a cellular system, which is unrelated to the teachings of the other cited part references and to the present optical system. Consequently, combining the teachings of the Lindoff patent with the teachings of the other references is improper and is based upon hindsight reconstruction.

Therefore, it is respectfully submitted that the invention recited in Claims 6 and 7 are not disclosed or suggested by the Ono et al., Kahn et al., Shimizu et al. patents in combination with the Lindoff publication, taken singly or together. Furthermore, dependent Claims 6 and 7 are considered patentable based upon the allowability of Claims 1 and 11 from which they depend. Therefore, withdrawal of the Examiner's rejection and allowance of Claims 6 and 7 are respectfully requested.

Claims 19 and 20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,388,786 issued to Ono et al. and US Patent No. 6,445,476 issued to Kahn et

al. in view of US Publication No. 20030012289 of Lindoff and US Patent No. 6,307,985 issued to Lindoff and US Patent No. 6,307,985 issued to Murakami et al.

As was argued above, the prior art references, taken singly or together, do not disclose or suggest "programmable constellation generating apparatus is reconfigured to generate respective amplitude control and phase control signals to produce a predistorted optical signal" as is recited in Claim 19, or that the "predistortion compensates for one or more factors selected from nonlinearity in an optical link, self-phase modulation and performance variations in components of a communications link" is recited in Claim 20.

Again, the cited references do not disclose or suggest programmable constellation generating apparatus or that "predistortion compensates for one or more factors selected from nonlinearity in an optical link, self-phase modulation and performance variations in components of a communications link." The components referred to include piece parts of the link, such as modulating lasers, amplifiers or detectors, for example.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure to the extent indicated by the Examiner.

In view of the above, it is respectfully submitted that the present application is in condition for allowance. Reconsideration and allowance of this application are earnestly solicited.

<div style="text-align: right">

Respectfully submitted,

Kenneth W. Float
Registration No. 29,233

</div>

The Law Offices of Kenneth W. Float
2095 Hwy. 211 NW, Suite 2F #356
Braselton, GA 30517
Telephone: (949) 257-7964
Facsimile: (770) 867-0082
E-mail: kwfloat@floatlaw.com